

Esri Response to NASA Request for Information - Preparation for the Development of a Community-Based Roadmap for NASA's Planetary Data Services

Response to Topic 3

3. How can the interaction between the PDS and data providers be improved to move data from the provider to the public as rapidly as possible?

- Name of submitter and contact information (institutional affiliation, E-mail address);

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NASA has been a valued Esri customer for over 20 years. Esri's full ArcGIS product stack is available to the majority of the scientific community at no additional cost, including all NASA and USGS missions. The majority of academic institutions worldwide maintain educational site licenses which also give their staff and students unlimited access to the ArcGIS Platform. Finally, qualified nonprofit organizations and individuals of the public can receive the full analytics product stack for as little as \$150. In addition to the powerful analytics and serving components above, ArcGIS includes a free viewing applications (such as StoryMaps and ArcGIS Earth) for the public to interact with and query the data. Further, ArcGIS has a full suite of free and open Software Development Toolkits (SDKs) and Application Programmer Interfaces (APIs) that scientists can use to develop custom clients.

Since 1969, Esri has helped organizations map and model our world. Our GIS technology allows users to effectively manage and analyze geographic information so they can make better decisions. We offer flexible, configurable, and easy-to-use geospatial solutions that let anyone access informative maps and location apps anywhere and on any platform or device. These solutions are supported by our experienced staff and extensive network of business partners and international distributors.

Esri applications provide the backbone for the world's mapping and location analysis. Esri software is used in more than 350,000 organizations worldwide including each of the 200 largest cities in the United States, more than two-thirds of Fortune 500 companies, more than 24,000 state and local governments worldwide, and many others in dozens of industries. Private ownership, a zero-debt policy, and a firm commitment to fulfilling the needs of our customers all help Esri maintain its position as the world leader in GIS software.

As a socially conscious business, we are proud that our technology is used by many organizations who apply location-based insights to solve problems and make our world a better place to live. We also actively support organizations involved in education, conservation, sustainable development, and humanitarian affairs.

- A clear and concise statement of the topic addressed;

The PDS maintains a requirement to disseminate large amounts of data in useable formats to the public and its scientists. The PDS must continue with current efforts to making archived data available as web services to ensure maximum accessibility of datasets in the future.

As PDS further de-emphasizes hard media distribution in favor of popular web services, it should also be mindful of differing requirements between access to archival quality data and interactive data browsing. Both types will be needed due to the variety and large time period of data the PDS hosts.

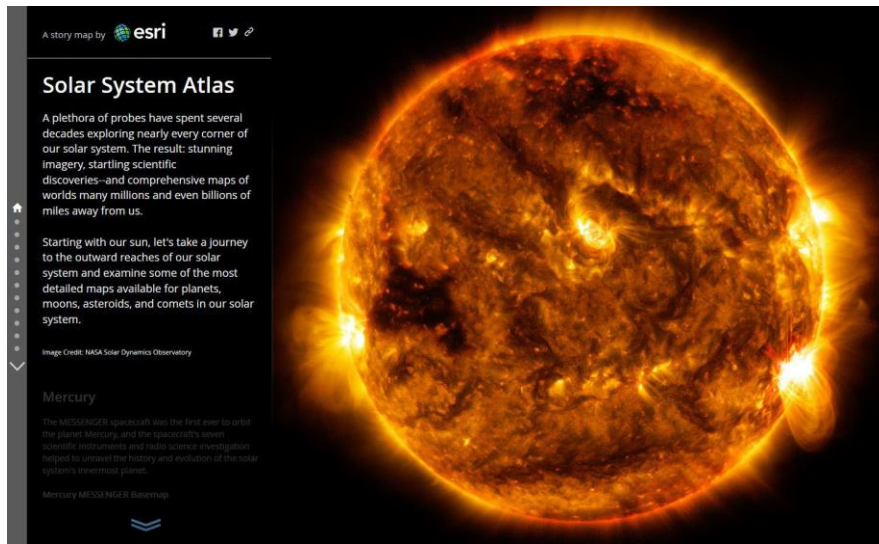
The method of leveraging web services for data dissemination not only increases the speed at which data can be accessed, but also decreases the administrative time spent creating copies of and mailing disks. To assist with this problem, we recommend that PDS leverage the wide availability of industry standard Esri GIS applications within NASA. This software will assist with data compression and web optimization and help you move PDS data products to web services.

- An articulate and compelling rationale for why the chosen topic would be significant to a wide range of planetary scientists;

As NASA's Citizen Science efforts increase, the public requires access to an ever-growing amount of data in easy-to-use formats, which are often of the higher order nature. (See Esri's response to question 6 for more information on how PDS's use of a GIS can assist with creating and accessing higher order data products.) Experienced planetary scientists require access to lower order data formats for peer review and further analysis. The migration of data to web services allows for higher and lower order data to be made available in concert with one another, both of which can be accompanied by rich metadata. By making data available as web services, the PDS will support collective workspaces to help planetary scientists collaborate quickly and cost effectively in a secure environment from across their facility or the world. Finally, migration of datasets to web services will ensure that the data is not just open, but also discoverable and useable by the masses.

The Solar System Atlas

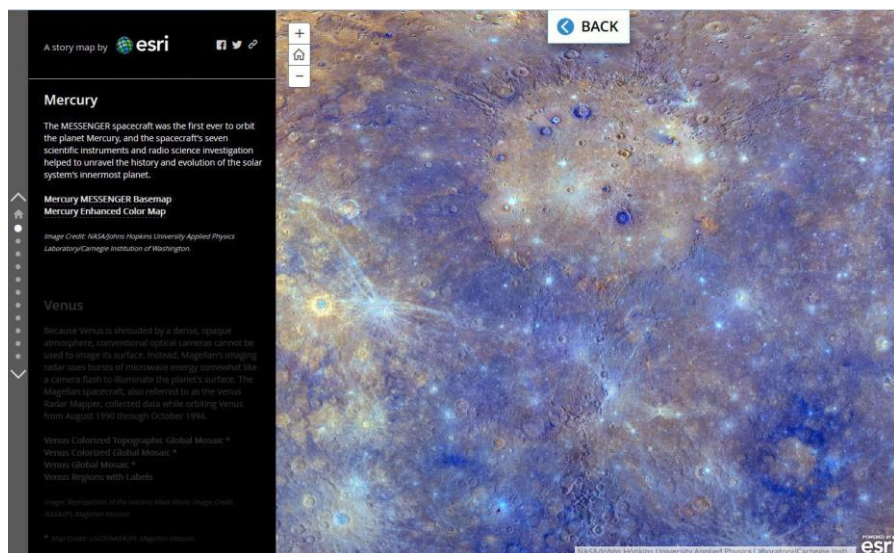
As an example of what can be done with web services, Esri created a [Solar System Atlas](#). Built using Esri [StoryMaps](#) technology, it gathers together more than 50 dynamic web service maps into a single app. Starting with our sun, Esri's Solar System Atlas takes public users on an interactive journey to the outward reaches of our solar system to examine many of the most detailed maps available for planets, moons, asteroids, and comets in our solar system.



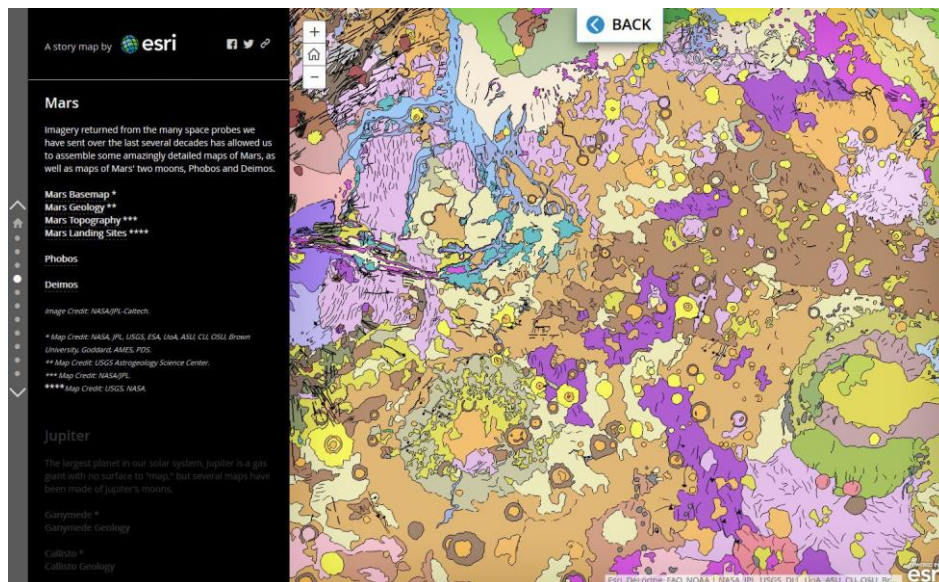
Esri's Solar System Atlas.

Esri's Solar System Atlas exemplifies how the PDS can use configurable, no-cost templates to provide powerful educational tools for teachers, students, and the general public. It's also a great way to inform the public of the return on investment of space exploration programs. The Solar System Atlas is an example of Esri's commitment to continuously improving support for planetary GIS.

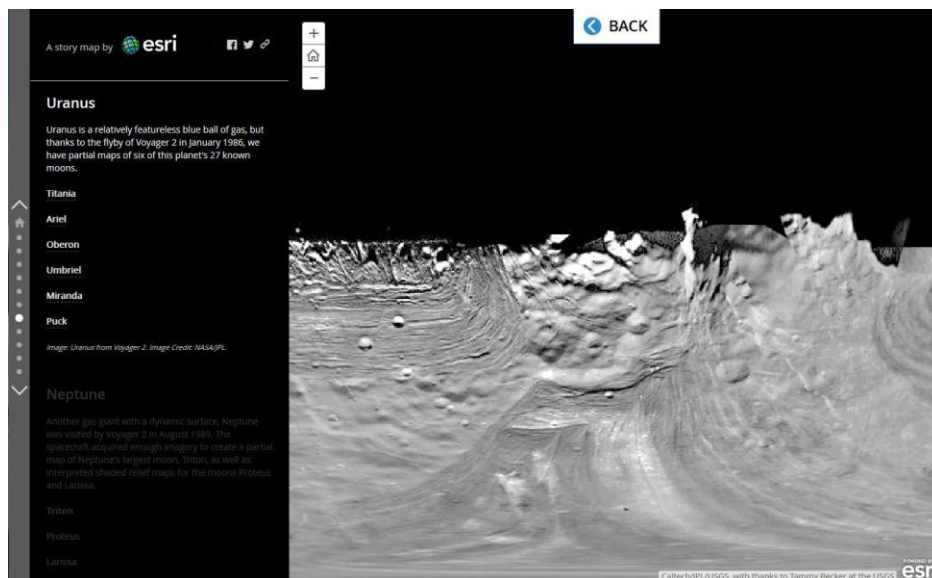
The individual maps presented in Esri's Solar System Atlas are not static images but interactive maps, allowing viewers to zoom in and out as well as pan around the surface to explore for themselves. Some maps even contain pop-ups where users can interact with metadata.



Mercury image in Esri's Solar System Atlas



Mars geology in Esri's Solar System Atlas



Uranus image in Esri's Solar System Atlas

- Suggested improvements or changes relevant to the topic;

In support of the above, the PDS should leverage ArcGIS web services, which are the most common and popular services within the geospatial framework. While being fully compatible with the OGC web service specifications and standards, ArcGIS web services go much further. They provide a much tighter integration between web services, the free ArcGIS APIs and SDKs for visualization, and the many configurable applications which comprise the ArcGIS ecosystem. This includes the freely available ArcGIS

Online and ArcGIS Earth tools, the latter of which was released in collaboration with Google, given the deprecation of Google Earth. Further, the ArcGIS web API is well documented and will continue to be supported and evolved by Esri over the next 10 years, ensuring a highly capable distribution platform.

The ArcGIS Open Data application and Esri GeoPortal Server can help the PDS document and catalog available datasets. (For more information about this, see Esri's response to question 7.) The highly interoperable nature of ArcGIS can make it easier to accept and disseminate data in a variety of formats, including those that the PDS standardizes on. ArcGIS's templates and applications provide easy frontends to consume the data, as well as free APIs and SDKs for easily built applications.

By providing ArcGIS web services as soon as possible, you can rapidly disseminate data to the public, since most science and academic institutions already have access to ArcGIS professional tools. As far as the public at large, many lighter ArcGIS client applications (including Esri apps and third-party apps), are freely available to the public.

In addition, as a commercial off-the-shelf (COTS) platform, ArcGIS will continue to evolve as new technologies, data formats, and best practices emerge in the future. Moving to a COTS server platform like ArcGIS will help you maintain workflow continuity and data interoperability, since you know new standards and techniques will be integrated into the server platform. Non-COTS server platforms, however, are very difficult to update in the long term, posing the risk that new data in new formats might not be able to be integrated with legacy server applications. By using ArcGIS, you can keep current with technology trends and avoid this risk.

ArcGIS is also optimized for deployment in the cloud, giving you greater flexibility for your implementation. Cloud deployments are fast, require less up-front costs, and do not require you to purchase and maintain costly on-premises hardware. In some cases, the PDS may find that a cloud deployment is the best, fastest, and cheapest option for making data available to others.

- A discussion of the impact of not making the suggested improvements or changes; and,

Increased administrative costs from current methodology with decreased usage of planetary data products. Data trapped in increasingly obsolete technology.

- A discussion of the potential impacts of the suggested improvements or changes.

Decreased administrative costs with increased usability for citizen scientists and members of the ConnectED initiative. Reduced continuity of data access into the future.